Interactive comment on "TempestExtremes v1.0: A Framework for Scale-Insensitive Pointwise Feature Tracking on Unstructured Grids" *by* Paul A. Ullrich and Colin M. Zarzycki

Paul A. Ullrich and Colin M. Zarzycki

paullrich@ucdavis.edu

Reviewer #2.

This manuscript is a valuable contribution to storm tracking methodology, with several innovative approaches: tracking on unstructured grids, the use of great-circle distance calculations, and the implementation of a k-d tree algorithm to improve computational efficiency. The article is very well written and researched. I recommend publication with only very minor suggestions. One of the issues that should be investigated is

how well the authors' storm tracking software works on numerical model output with higher horizontal resolution, such as ECMWF 9 km forecasts, which are relied on at many operational weather forecasting centers. In particular, currently deployed storm tracking software often fails to find the center locations of weak, shallow, or highly-sheared tropical cyclones. This presents a unique opportunity for TempestExtremes. If it proves capable of generating well behaved, consistent storm tracks for these weak cyclones when other trackers fail, it would be an invaluable tool for the tropical forecasting community.

You might want to test your TempestExtremes software on weak tropical cyclones in the GFS and other model output then compare it with the forecast aids (tracker output) in the ATCF "a-deck" to quantify its performance.

Based on the reviewer's suggestion, we have added a new example entitled "Tropical cyclone forecast trajectories" which uses the algorithm to track 14km CAM output data produced from a simulation of Hurricane Sandy, and compares the results against the NCEP vortex tracker. Overall, the tracker shows consistent performance with NCEP's scheme.

A question for the authors: Could TempestExtremes be extended to multiple dimensions and used as a coherent feature recognition/object tracking tool? Forecasters sometimes want to track an area of high winds, energy or moisture that rotates around a weather system as the entire system is moving in a general direction. If a contour (closed group of edge points) could be tracked, then this would greatly improve temporally interpolated positions of vortex features, for example. The authors should be commended for making their tracker software available through GitHub. I agree with other reviewers that a nice step-by-step example with documentation would be a valuable addition to the package and would encourage its use.

Although TempestExtremes does not have a 3D tracking capability, it does include an experimental capacity to track 2D contours (in our nomenclature we refer to these features as "blobs"). We are currently using this capability to examine atmospheric blocking regions and atmospheric rivers, but agree that it would be advantageous to apply this capability to other features. We are very much open to collaborations that would allow us to further expand the capabilities of the software framework, or see it applied to other problems of interest.